

remeasuring, using secondary ion mass spectrometry (SIMS), the abundance of the one or more mass tags at a plurality of locations occupied by the identified one or more cells of interest, thereby generating, for each individual cell remeasured, a second set of data; and outputting the second set of data for each of the identified cells of interest.

15. A method of analyzing a test population of cells, comprising:

- i) obtaining an array of cells on a substrate, wherein the cells are labeled with one or more mass tags and are separated from one another;
- ii) measuring, using SIMS, the abundance of the one or more mass tags at a plurality of locations occupied by the cells, thereby generating, for each individual cell measured, a set of data;
- iii) generating a histogram showing the distribution of the mass tags across the test population of cells; and
- iv) comparing the histogram to a reference histogram obtained from a reference population of cells.

16. The method of claim **15**, wherein the method further comprises:

- v) identifying one or more cells of interest based on a threshold value for the abundance of the one or more mass tags.

17. The method of claim **16**, wherein the threshold value is determined based on the reference histogram.

18. The method of claim **15**, wherein the test population of cells has been contacted with a test agent and the reference population of cells has not been contacted with the test agent.

19. The method of claim **15**, wherein the test population of cells is obtained from a subject diagnosed with a condition and the reference population of cells is obtained from a healthy subject.

20. An automated system for analyzing an array of cells, the system comprising:

- a) a SIMS system comprising a holder for retaining a substrate comprising an array of cells, wherein the cells are labeled with one or more mass tags and are separated from one another, wherein the system is configured to:
 - (i) measure the abundance of the one or more mass tags at a plurality of locations occupied by the cells of the array using SIMS;
 - (ii) generate a data set that comprises the measurements of the abundance of said one or more mass tags; and
 - (iii) output the data set; and
- b) a computer comprising an analysis module that analyzes said data set.

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